

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 0 592 921 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**21.01.1998 Bulletin 1998/04**

(51) Int Cl.<sup>6</sup>: **G05B 23/02, G06F 3/033**

(21) Application number: **93116076.6**

(22) Date of filing: **05.10.1993**

**(54) Process control with graphical attribute interface**

Prozesssteuerung mit graphischer Schnittstelle von Attributen

Contrôle du procédé avec interface graphique des propriétés

(84) Designated Contracting States:  
**DE FR GB IT**

(30) Priority: **05.10.1992 US 958046**

(43) Date of publication of application:  
**20.04.1994 Bulletin 1994/16**

(73) Proprietor: **Fisher-Rosemount Systems, Inc.**  
**Austin, Texas 78754 (US)**

(72) Inventor: **Riley, Kenneth P.**  
**Round Rock, Texas 78664 (US)**

(74) Representative:  
**Bohnenberger, Johannes, Dr. et al**  
**Meissner, Bolte & Partner**  
**Postfach 86 06 24**  
**81633 München (DE)**

(56) References cited:  
**EP-A- 0 389 132 EP-A- 0 483 035**  
**WO-A-91/06050**

- **ELEKTROTECHNISCHE ZEITSCHRIFT** vol. 109,  
no. 12, June 1988, **BERLIN, GERMANY**, pages  
532 - 537 F. **KNOOP AND G. SCHINZE** 'Optimale  
Mensch-Maschine-Schnittstelle zur Führung  
von Versorgungsnetzen'

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

**EP 0 592 921 B1**

## Description

The present invention relates to a computer-based process controller, and more particularly to a method of graphical display of selected process attributes and a system for formatting and displaying attribute data.

The article by F. Knopp et al in *Elektrotechnische Zeitschrift*, Vol. 109, Nr. 12, June 1988, Berlin, discloses an interface for control of power supply grids making use of a window technique. Various segments of the grid in different hierarchies can be displayed, wherein a particular object on the display can be selected and the condition thereof displayed in a dialog window. A typical attribute displayed there comprises for example the parameters of a transformer currently in operation. The article makes no reference to storing historical data on the object attributes.

The European patent application EP-A-0 483 035 relates to a rework station used in an assembly line for producing computer cards having various electric components. The rework apparatus comprises means for storing and retrieving parameter information on the components including information on possible defects thereof. Display means are provided for displaying a graphical representation of the card assembly currently under diagnosis. Memory means are also provided containing the results of previous tests for the components as well as the previous history of repair actions taken with respect to given components.

Processing plants typically include a series of operations in which liquid, gas and solid materials are transported, heated, mixed, chemically treated, cooled, pressurized or otherwise processed. Each of the operations in a processing plant are monitored and controlled to ensure that each is performed according to some predetermined specification or criteria. The monitoring and control typically requires instrumentation including sensors for various process conditions, transmitters for transmitting the sensed data to a computer-based controller, a computer-based controller that receives the transmitted sensed data and that takes appropriate control action based on the sensed data, and controlled elements within the process such as valves, pumps, conveyors, heating or cooling elements, alarms, and the like, which are connected to and controlled by the process controller in order to maintain the sensed process conditions within predetermined desired limits to thereby control the operation of interest.

Typical processing plants, such as oil refineries, petrochemical plants, food processing plants, or drug processing plants, may include operations that have tens or hundreds of such so-called "loops", each of which may contain any type of sensor and transmitter, the computer-based controller, and any type of controlled element. Such loop-based operations are typically represented by loop drawings or loop sheets which graphically illustrate the loop or loops of the operation of interest.

With the advent of Computer-Aided Design (CAD) programs, loop drawings are created and stored in a computer memory, and are displayed on a display screen, thus simplifying the creation and maintenance of loop sheets. With such CAD programs, creation of the loop sheets is accomplished by an operator instructing the computer, using a digitizer or mouse, to place and connect graphical representations of the components of the operation on the display screen of the computer-based controller.

Such CAD programs and computer-based process controllers also facilitate the maintenance of historical data related to the operation under control. Such data historians operate much like flight recorders on aircraft, and serve to record a history of the states and other attributes of all control elements in an operation. The maintenance of such historical data has proven particularly critical when the operation being controlled relates to the manufacture of foods and/or drugs.

Typical data historians simply keep track of all attributes of all components of the operation under control, and maintain the data history in a large history data base. Then, when review of the history data base is desired, for example, after the detection of a process upset or other error, the history data base is output in the form of a spread sheet, thus permitting a system operator to analyze the historical data to determine the cause of the upset or error. During such an analysis, an operator reviews the spread sheet of historical data, in combination with a loop sheet drawing, to render conclusions, for example, as to the cause of the upset or other error. Such analyses have proven difficult because large portions of the history data base may not be relevant to the particular loop or process upset under consideration. In addition, correlating the data history with a loop sheet of interest to determine the history of a particular component of the operation of interest, often proves time consuming and occasionally results in errors.

There is therefore a need to provide an easier method to correlate data history with individual components in a computer-based process controller.

According to the present invention, a method and a system of displaying attribute data are provided as defined in claims 1 and 5, respectively.

The display of the process attributes may take the form of a dialogue box which is overlaid on top of the graphical representation of the process being controlled thus permitting the substantially simultaneous display of the graphical representation and underlying process attributes.

The process attributes that may be displayed may be virtually any attribute that is associated with a process element. For example, process attributes may include the identity of the process element including its part number, drawing number, manufacturer, and the like, the characteristics of the process element including, for example, the physical and electrical characteristics including the engineering units and range of the

output signal produced by the process elements, and the state history of the process element, for example, the state of the output of a process element for a particular point in time.

Attributes that may be displayed in accordance with the present invention include static attributes and dynamic attributes. Static attributes (for example, element identity and characteristics) may be entered manually, whereas dynamic characteristics (for example, output state) may be derived from a historical data base, and formatted for inclusion among the attributes to be displayed.

These and other advantages of the present invention will become apparent to those of ordinary skill in this art with reference to the figures and following detailed description of embodiments.

Figure 1 is an example of a graphical display of a process and instrumentation diagram.

Figure 2 is an example of a graphical display of a loop sheet with a graphical attribute interface, in accordance with the embodiment.

Figures 3-5 are additional examples of graphical attribute interfaces, in accordance with the embodiment.

Figure 6 is a system block diagram showing the functional requirements for implementing the graphical attribute interface which is used by the embodiment.

Figure 7 is a flow chart showing the logic of the graphical attribute interface of the embodiment.

Figure 8 is a flow chart showing in more detail the process user request function of Figure 7.

Figure 9 is a flow chart showing in more detail the load drawing function of Figure 8.

Figure 10 is a flow chart showing in more detail the unload drawing function of Figure 8.

Referring to Figure 1, there is shown a screen from a computer display 90 which illustrates a loop sheet in the form of a process and instrumentation diagram (P&ID), for a batch kettle control. In Figure 1, the bold lines indicate pipes or conduits for liquid, steam or vapor, the fine lines indicate hardware connections, and the fine lines with circles indicate software connections.

The screen display of Figure 1 shows kettle 100 surrounded by steam jacket 101, which is connected to steam line 102, cooling water supply line 103, condensate return line 104, and cooling water return 106. The input of unprocessed product is illustrated by use of charge header line 107, and processed product is removed for storage via outflow line 108. Also illustrated is vapor recovery line 109.

Within kettle 100 is illustrated stir bar 111 which is driven by motor 112. Also within kettle 100 is temperature sensor 113.

Illustrated in the P&ID of Figure 1 are several process operation components illustrated using standard process instrumentation symbols.

For example, lines 102, 103, 104, 106, 107 and 108 each respectively include valves 112, 113, 114, 116, 117 and 118. Each valve has associated therewith a valve

state indicator (YV) and a valve indicator and controller (YIC). For example, outflow line 108 includes outflow valve 118 which has associated therewith a valve state indicator (YV) 119, and a valve indicator and controller (YIC) 120.

Vapor recovery line 109 includes a flow transducer 121 which is connected through flow transmitter (FT) 122 to flow rate indicator and controller (FIC) 123.

Temperature indicator 113 is connected through temperature transmitter (TT) 126 to temperature indicator and controller (TIC) 127. Also provided to TIC 127 is the control output of valve indicator and controller (YIC) 128, which is connected to monitor motor 112.

Finally, the software control outputs of FIC 123 and TIC 127 are applied to temperature converting relay (TY) 129 which is illustrated as controlling valve 131 within steam line 102.

Associated with each component illustrated in the P&ID of Figure 1, for example, associated with each valve, valve state indicator (YV), indicator and controller (YIC), sensed signal transmitter (TT, FT), and flow or temperature indicator and controller (FIC, TIC), are so-called process attributes which completely define the identity and state of the particular component. In other words, associated with each graphical or icon representation of a control element in a P&ID such as that illustrated in Figure 1, are one or more process attributes.

For example, process attributes may include the name of the control element, the type, part number, and manufacturer of the control element, reference to the drawing for the control element, if the control element is a physical element, the type of signal output by the control element (for example, analog or digital), the engineering units for the signal or signals produced by the control element as well as the range for the output signal, the high and low alarm limits for the output signal, the value of the output signal at a particular point in time, the last time the control element was maintained, and so forth. There are virtually an infinite number of different types of process attributes for the possible control elements used in processing plants. In general, the process attributes reveal the identity, characteristics and/or state of a respective control element.

Rather than requiring a control system designer or processing plant operator to search through an extensive history data base to determine the particular process attributes for the control element or elements of interest, the present invention allows selected process attributes to be formatted and displayed along with the graphical representation of the operation (for example, the P&ID sheet of the operation under consideration). By using a user positionable cursor or cross-hair, a user may select a desired control element for which the underlying process attributes are to be displayed.

For example, and with reference to Figure 2, an embodiment of the present invention contemplates the use of a cursor (such as cross-hairs 200) which is selectively placeable anywhere on the image of the P&ID sheet by

use of a mouse, key board, joy stick, or other user input device, in order to select a particular control element of interest (for example, FT 122). Once a desired control element has been selected, a dialogue box 201 is displayed overlying the graphical representation of the P&ID sheet. Dialogue box 201 may take any form, however, in the preferred embodiment, dialogue box 201 includes at least two fields; a process attribute identity field 202 and a process attribute value field 203. Identity field 202 includes a brief description of the identity of the process attribute of interest, the value for which is displayed in the relevant entry of process attribute value field 203. Dialogue box 201 also includes graphical instruction boxes 204 and 205 with which the user may change or set attribute values by selecting an attribute value field 203 and entering a new value. Once changes have been made to values within field 203, selecting box 204 ("OK") saves the new values or selecting box 205 ("CANCEL") retains the original values. In any case, selecting box 204 then box 205 closes the dialogue box 201.

Figures 3, 4 and 5 present examples of different types of dialogue boxes 201 which are illustrative of dialogue boxes that may be displayed for various control elements revealed in the P&ID sheet of Figure 1. It should be understood that for each dialogue box illustrated in Figures 3, 4 and 5, more or fewer process attribute identifiers may be included within the process attribute identification field, which would result in more or fewer process attribute values being displayed in the process attribute value fields.

Referring specifically to Figure 3, presented is an exemplary dialogue box 201A which may be overlaid on the P&ID sheet of Figure 1 (as illustrated in Figure 2), if the flow transmitter (FT) 122 was selected by the user for display of underlying attributes.

In dialogue box 201A, process attribute identification field 202A includes a "tag" entry, with the corresponding value in field 203A being the tag that appears on the P&ID sheet for FT 122. Other attribute identifiers and values appearing in fields 202A and 203A indicate that FT 122 produces an output signal that is analog. The "device" and "address" entries in fields 202A and 203A indicate the hardware box actually housing the transmitter, and the address within that box. Finally, attribute identification and value fields 202A and 203A include entries for the engineering units of the output signal of FT 122 (ma), and the high and low values permitted for the output signal, in the specified engineering units.

Referring now to dialogue box 201B in Figure 4, presented is an exemplary dialogue box which may be displayed when the user selects product outflow valve 118 of the P&ID sheet of Figure 1 for display of underlying attributes.

Process attribute identification and value fields 202B and 203B include entries that identify the name, type, part number and manufacturer of the valve in in-

terest. In addition, the identification of the valve specification sheet is provided. Finally, fields 202B and 203B include entries for the last maintenance date for outflow valve 118.

The dialogue boxes 201A and 201B shown in Figures 3 and 4 do not include process attributes that vary as the process proceeds. In other words, the process attributes are static rather than dynamic. The "Maintenance Date" entry in dialogue box 201B is periodically updated when the outflow 118 is maintained, but the other entries in dialogue box 201B do not vary as the process continues.

In contrast, other control elements, including control elements presented in icon form in the P&ID sheet of Figure 1, do include process attributes that vary with time (i.e., dynamic attributes). For example, flow rate indicator and controller 123 produces an output signal which is indicative of the vapor flow rate detected by flow sensor 121 and transmitted by flow transmitter 122.

Figure 5 presents an exemplary dialogue box 201C for flow rate indicator and controller 123. Similar to dialogue boxes 201A and 201B of Figures 3 and 4, dialogue box 201C for flow indicator and controller 123 reveals several process attributes that do not vary as the process proceeds. However, dialogue box 201C includes a process attribute identified as "Process Variable" with a corresponding value. This value (in units of gallons per minute) varies in proportion to the flow of vapor in line 109 as sensed by flow sensor 121 and as transmitted by flow transmitter 122, and will thus vary as the process under control proceeds. In a similar fashion, although the "Set Point", "High Alarm", and "Low Alarm" entries in dialogue box 201C are typically fixed throughout the duration of a control process, these values may either be changed by the operator or may be changed automatically under software control at any time.

As explained earlier, a data historian maintains values for these process attributes in a history data base in a known manner. The present invention operates to select and format particular process attributes for presentation in dialogue boxes which are overlaid upon the display of the loop sheet or P&ID sheet of interest. This provides a graphical display of process attributes for any point in time that is recorded in the history data base.

Referring now to Figure 6, there is shown in functional block diagram form the graphical display of process attributes. The key parts of the embodiment are an AutoCAD drawing file 601, a data historian or historical data file 602, a mask file 603, and a processor 604 which processes user requests input through interface 605 to produce drawings including graphical representation of process attributes. These drawings are stored in AutoCAD drawing file 601, and are constructed from the AutoCAD drawing file 601, historical data file 602, and mask file 603, as described in more detail below. Drawing data file 607 is used to store a representation of the process attributes refined by mask file 603.

Historical data file 602 contains attribute data which

is to be loaded into the drawing. The data is organized by records, and each record contains a number of fields as defined by the mask file 603. The mask file 603 contains the definition of the structure records in the historical data file 602. The record definition is the list of attributes in each record in the historical data file. Attributes in the record which are preceded by a special marking character (for example, a "@" character) are used as the key attributes for loading data from the historical data file 602.

The preferred embodiment uses the interface provided in the AutoCAD Development System provided as part of AutoCAD release 11, and provides a mechanism for keeping process documentation up to date with the process itself. A user may load and unload the process data directly into and out of process drawings. The preferred embodiment is designed to operate on the Fisher Controls ENVOX Open Database product, however, those of skill in this art will be able to apply the invention to other spread sheet and data base applications without undue experimentation.

The embodiment uses the concept of "key attributes" which refers to the process attribute within a block of attributes whose value - the "key value" - designates the block for use in a drawing function, whether a load or an unload drawing function (described in detail with reference to Figures 9 and 10).

Referring now to Figure 7-10, presented is a flow chart of the logic of the graphical attribute interface implemented in software. One of ordinary skill in the art may write source code from this flow chart in any suitable computer program language, such as Pascal, C, or FORTRAN for any desired computer system, such as IBM PC's or IBM compatible computers or other computers which support these computer languages.

The process begins by initializing the users interface in step 1. This is done in accordance with the standard AutoCAD Development System interface procedures. Control then passes to step 2 where user input is awaited. Once user input is received, control passes to step 3 where the user request is processed. Step 3 uses as inputs, the historical data file 602, the mask file 603, the AutoCAD drawing file 601, and/or process attribute data from the drawing 607.

Figure 8 shows in more detail the processing of the process user request (step 3) of Figure 7. Beginning in step 3.1, the function code of the entered request is determined, and control passes either to the load drawing function 3.2 or the unload drawing function 3.3, which are described in more detail with reference to Figures 9 and 10. After either the load drawing function 3.2 or unload drawing function 3.3 is completed, control passes to block 3.4 where drawing clean up is performed including, for example, releasing memory allocated for data structures and closing open files. Processing then ends.

Referring now to Figure 9, the load drawing function 3.2 of Figure 8 is described in more detail. Beginning in block 3.2.1, the mask file 603 is parsed. In other words,

the mask file 603 is read and a structure is created from the mask file that defines the meaning of each item of data in historical data file 602. Control then passes to block 3.2.2 where the historical data file 602 is parsed according to the information contained within mask file 603. Control then passes to block 3.2.3 where the updating of dialogue boxes included in the AutoCAD drawing file 601 is begun.

In block 3.2.3, the first dialogue box to be updated is determined from information in the mask file 603, historical data file 602 and AutoCAD drawing file 601. Control then passes to block 3.2.4 where the attribute data for the dialogue box under consideration is found in the historical data file. Control then passes to 3.2.5 where the dialogue box is updated. Control then loops back to block 3.2.3 for continued operation, until no additional dialogue box entities are discovered. Control then passes to block 3.2.6 where the AutoCAD drawing is regenerated and displayed.

Turning now to figure 10, the unload drawing function 3.3 of figure 8 is described in more detail. Beginning in block 3.3.1, the mask file is parsed to establish the format of data to be output from AutoCAD drawing file 601 to the data from drawing file 607, and control passes to 3.3.2 where the data from drawing file 607 is opened. Then, in block 3.3.3, the AutoCAD drawing is reviewed in accordance with the parsed mask file data to identify each dialogue box. For each identified dialogue box, control then passes to block 3.3.4 where an output record is built from the dialogue box identified in block 3.3.3. Looping control continues in blocks 3.3.3 and 3.3.4 until no more dialogue boxes are found in AutoCAD drawing 601. Control then passes to block 3.3.5 where the output record is saved, in accordance with the parsed mask file 603, in the data from drawing file 607 established in block 3.3.2.

## Claims

1. A method of generating graphical display of process attributes in a computer-based process controller, comprising:

displaying a graphical representation (P&ID) of a process being controlled;

storing in a historical data file (602) a history of underlying process attributes (203) for a plurality of points in time during the operation of a process being controlled;

storing in a mask data file (603) information relating said history of underlying process attributes (203) to corresponding process elements (112 - 118) in said graphical representation;

selecting a portion of the graphical representation (P&ID) and a point in time for which underlying process attributes (203) from said history are to be displayed; and

5

displaying said underlying process attributes (203) of the selected portion of the graphical representation (P&ID) for the selected point in time substantially simultaneously with the display of said graphical representation.

10

2. The method of claim 1, wherein said step of displaying said process attributes (203) comprises, overlaying indicia (201) of said process attributes over said graphical representation.

15

3. The method of claim 1 or 2, said graphical representation comprising icons (119 - 129) of process elements (112 - 118), said step of selecting a portion of the graphical representation comprising, selecting an icon of a process element for which underlying process attributes (202, 203) are to be displayed.

20

4. The method of claim 3, wherein said underlying process attributes include an identification (202B) of a corresponding process element, characteristics (203B) of said corresponding process element, and states (203C) of said corresponding process element.

25

30

5. A system for formatting and displaying process attribute data with graphical process data, comprising:

35

a drawing file (601) including at least one graphical representation (P&ID) of a process being controlled, said at least one drawing including a plurality of process elements (112 - 118);

40

a historical data file (602) in which is stored historical data related to process attributes (202, 203) underlying each of said plurality of process elements (112 - 118) for a plurality of points in time;

45

a mask data file (603) including information which relates said historical data to corresponding process elements (112 - 118) in said at least one graphical representation; and

50

a data processor (604), operatively connected to said drawing file (601), historical data file (602) and

55

mask file (603), for combining said at least one graphical representation (P&ID) with said his-

torical data according to said information in said mask file (603), to produce a combined display of said of at least one graphical representation with process attributes (202, 203) underlying at least one of said plurality of process components (112 - 118) for a selected point in time.

## Patentansprüche

1. Verfahren zum Erzeugen einer graphischen Anzeige von Prozeßattributen in einer rechnergestützten Prozeßsteuerung, das die folgenden Schritte aufweist:

Anzeigen einer graphischen Darstellung (P&ID) eines gesteuerten Prozesses;

Speichern einer Historie von zugrundeliegenden Prozeßattributen (203) in einer Historien-datei (602) für eine Vielzahl von Zeitpunkten während des Ablaufs eines gesteuerten Prozesses;

Speichern von Information, die die Historie der zugrundeliegenden Prozeßattribute (203) mit entsprechenden Prozeßelementen (112-118) in der graphischen Darstellung in Beziehung setzt, in einer Maskendatei (603);

Auswählen eines Teils der graphischen Darstellung (P&ID) und eines Zeitpunkts, für den zugrundeliegende Prozeßattribute (203) aus der Historie anzuzeigen sind; und

Anzeigen der zugrundeliegenden Prozeßattribute (203) des ausgewählten Teils der graphischen Darstellung (P&ID) für den ausgewählten Zeitpunkt im wesentlichen gleichzeitig mit der Anzeige der graphischen Darstellung.

2. Verfahren nach Anspruch 1, wobei der Schritt des Anzeigens der Prozeßattribute (203) das Überlagern der graphischen Darstellung mit Kennzeichnungen (201) der Prozeßattribute aufweist.

3. Verfahren nach Anspruch 1 oder 2, wobei die graphische Darstellung Piktogramme (119-129) von Prozeßelementen (112-118) aufweist, wobei der Schritt des Auswählens eines Teils der graphischen Darstellung das Auswählen eines Piktogramms eines Prozeßelements aufweist, für das zugrundeliegende Prozeßattribute (202, 203) anzuzeigen sind.

4. Verfahren nach Anspruch 3, wobei die zugrundeliegenden Prozeßattribute eine Identifikation (202B) eines entsprechenden Prozeßelements, Charakteristiken (203B) des entsprechenden Prozeße-

ments und Zustände (203C) des entsprechenden Prozeßelements einschließen.

5. System zum Formatieren und Anzeigen von Prozeßattributdaten mit graphischen Prozeßdaten, das folgendes aufweist:

eine Zeichnungsdatei (601), die wenigstens eine graphische Darstellung (P&ID) eines gesteuerten Prozesses einschließt, wobei die wenigstens eine graphische Darstellung eine Vielzahl von Prozeßelementen (112-118) einschließt;

eine Historiendatei (602), in der Historien-Daten gespeichert sind, die mit Prozeßattributen (202, 203) in Beziehung stehen, die jedem aus der Vielzahl von Prozeßelementen (112-118) für eine Vielzahl von Zeitpunkten zugrundeliegen;

eine Maskendatei (603), die Information einschließt, welche die Historien-Daten mit entsprechenden Prozeßelementen (112-118) in der wenigstens einen graphischen Darstellung in Beziehung setzt; und

einen Datenprozessor (604), der mit der Zeichnungsdatei (101), der Historien-Datei (602) und der Maskendatei (603) betriebsmäßig verbunden ist, zum Kombinieren der wenigstens einen graphischen Darstellung (P&ID) mit den Historien-Daten gemäß der Information in der Maskendatei (603), um eine kombinierte Anzeige der wenigstens einen graphischen Darstellung mit Prozeßattributen (202, 203) zu erzeugen, die wenigstens einer aus der Vielzahl von Prozeßelementen (112-118) für einen ausgewählten Zeitpunkt zugrundeliegen.

## Revendications

1. Méthode pour générer l'affichage graphique des attributs d'un procédé dans un contrôleur de procédé informatique comprenant des étapes consistant à:

afficher une représentation graphique (P&ID) du procédé à contrôler;

stocker dans un fichier de données historiques (602) l'historique des attributs du procédé concerné (203) pour une pluralité d'instantants pendant le fonctionnement du procédé sous contrôle;

stocker dans un fichier de données de masques (603) une information relative à l'histori-

que des attributs sous-jacents (203) du procédé vers des éléments de procédé correspondants (112 - 118) dans la représentation graphique;

choisir une partie de la représentation graphique (P&ID) et un instant où les attributs sous-jacents (203) du procédé doivent être affichés à partir de cet historique; et

afficher les attributs sous-jacents (203) du procédé pour la partie choisie de la représentation graphique (P&ID) pour un instant choisi sensiblement en simultanéité avec l'affichage de la représentation graphique.

2. Méthode selon la revendication 1, dans laquelle l'étape d'affichage des attributs de procédé (203) comprend l'étape consistant à superposer des indices (201) des attributs de procédé sur la représentation graphique.

3. Méthode selon la revendication 1 ou 2, dans laquelle la représentation graphique comprend des icônes (119 - 129) pour les éléments (112 - 118) du procédé, l'étape consistant à choisir une partie de la représentation graphique comprenant les étapes consistant à choisir une icône d'un élément de procédé pour laquelle les attributs sous-jacents (202, 203) du procédé doivent être affichés.

4. Méthode selon la revendication 3, dans laquelle les attributs sous-jacents du procédé comprennent l'identification (202B) d'un élément de procédé correspondant, les caractéristiques (203B) de l'élément de procédé correspondant et les états (203C) de l'élément de procédé correspondant.

5. Système pour formater et afficher des données d'attributs d'un procédé avec les données graphiques du procédé, comprenant:

un fichier de dessins (601) comprenant au moins une représentation graphique (P&ID) du procédé sous contrôle, une représentation graphique au moins comprenant une pluralité d'éléments de procédé (112 - 118);

un fichier de données historiques (603) dans lequel sont stockées les données historiques relatives aux attributs (202, 203) du procédé sous-jacents chacun à la pluralité d'éléments du procédé (112 - 118) pour une pluralité d'instantants;

un fichier de données de masques (602) comprenant des informations qui se rapportent aux données historiques vers les éléments de pro-

cédé correspondants au moins (112 - 118) dans la représentation graphique; et

un processeur de données (604), connecté fonctionnellement au fichier des dessins (601),  
au fichier des données historiques (602) et au  
fichier des masques (603), pour combiner au  
moins la représentation graphique (P&ID) avec  
les données historiques selon les informations  
dans le fichier des masques (603), afin de pro-  
duire un affichage combiné de la représenta-  
tion graphique au moins avec les attributs du  
procédé (202, 203) sous-jacents à au moins  
une pluralité d'éléments du procédé (112 - 118)  
pour un instant choisi.

5

10

15

20

25

30

35

40

45

50

55



FIG. 1

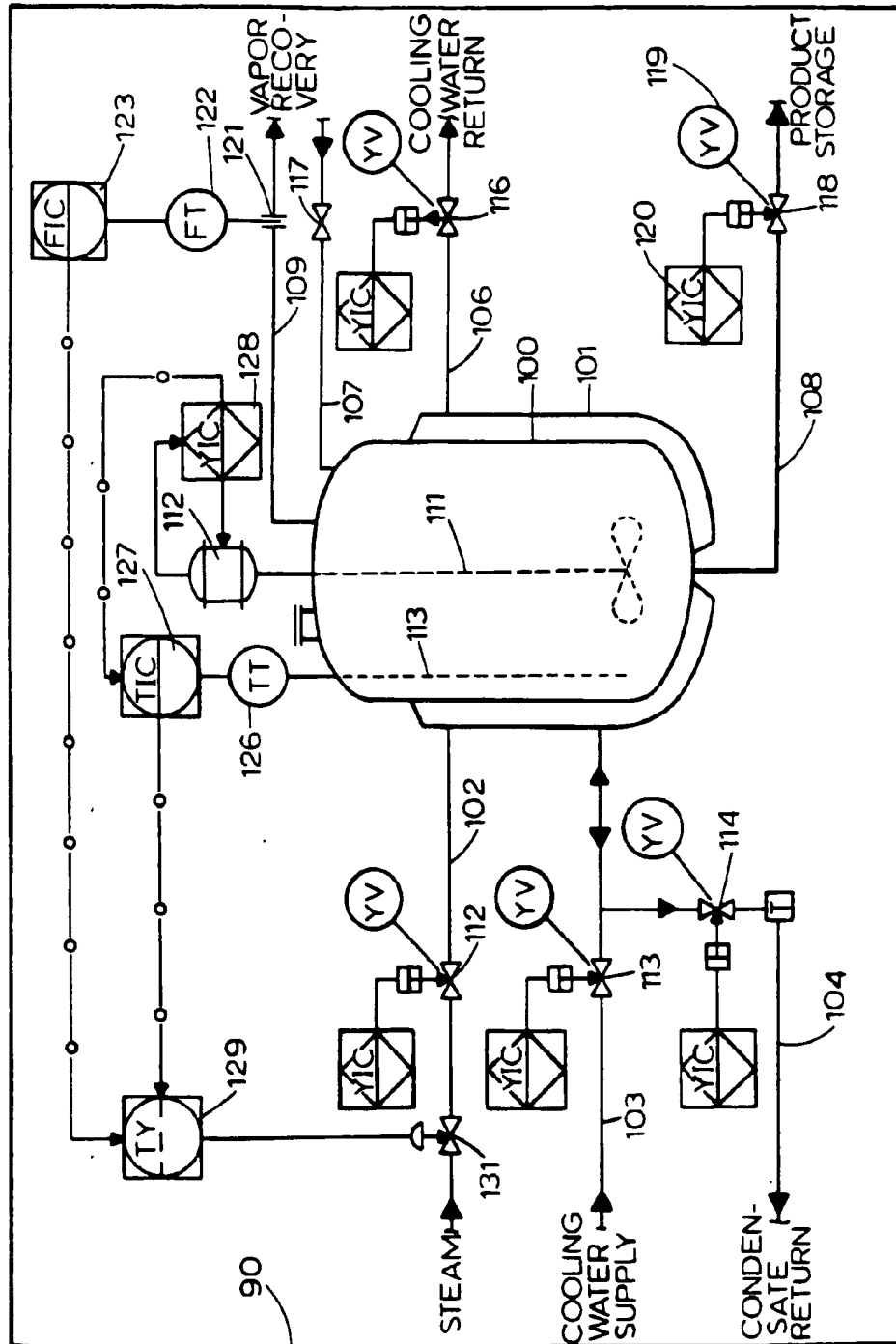


FIG. 2

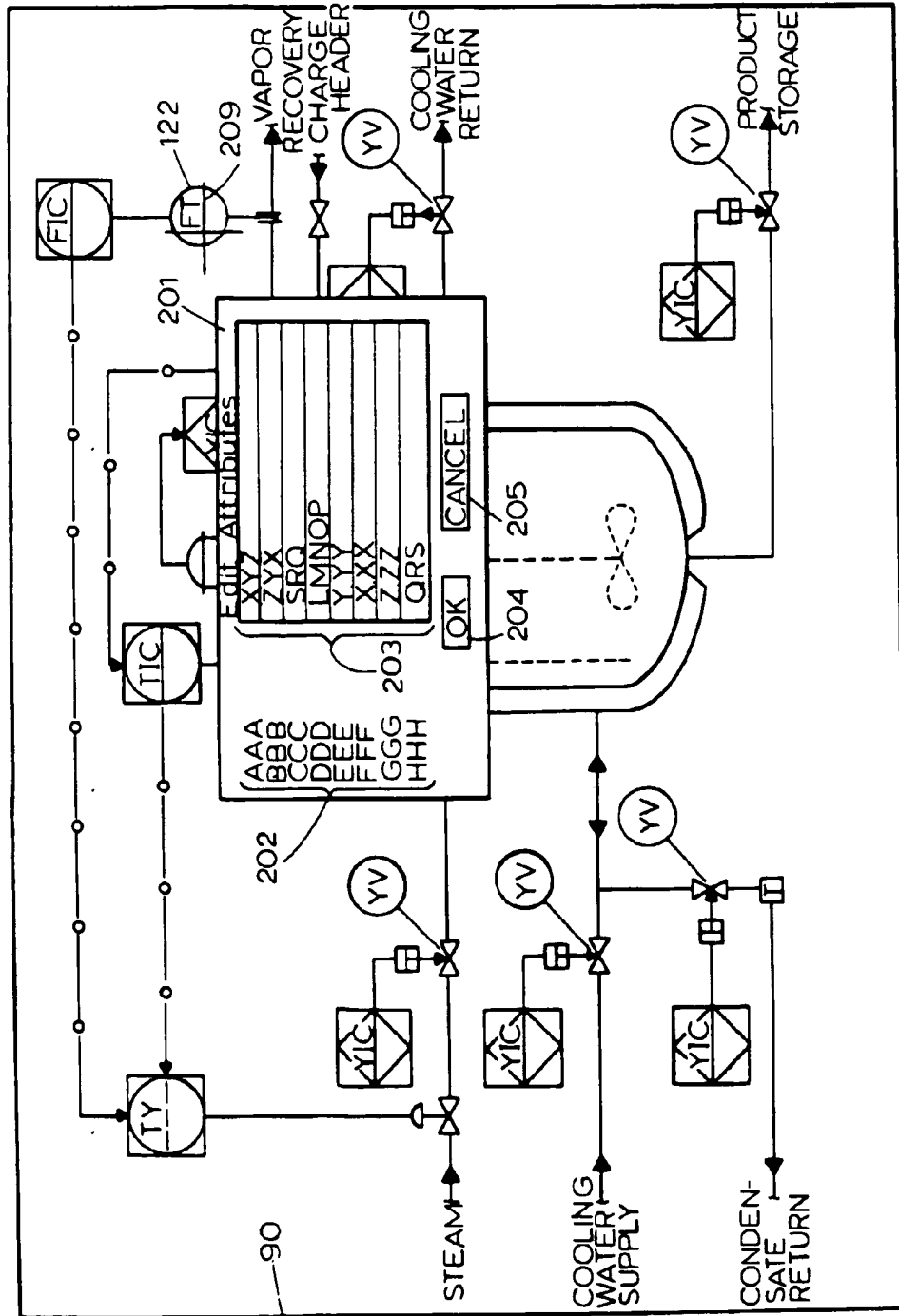


FIG. 3

202A

203A

201A

EDIT ATTRIBUTES	
TAG	FT030-1
SIGNAL TYPE	ANALOG
SIGNAL DIRECTION	OUTPUT
DEVICE	UOC1-15
ADDRESS	1-1-6
EU UNITS	mg
EU Low Value	4
EU High Value	20

OK CANCEL

FIG. 4

202B

203B

201B

EDIT ATTRIBUTES	
VALVE NAME	KETTL 1A OUTFLOW
VALVE TYPE	STANDARD 4Inch
PART NUMBER	VS-0004
MANUFACTURER	FISHER CONTROLS
SPEC SHEET	VS0004.DWG
MAINTENANCE DATE	1-Oct-1992

OK CANCEL

FIG. 5

202C

203C

201C

EDIT ATTRIBUTES	
TAG	FIC-409
DESCRIPTION	Vapor Flow Rate
UNITS	GPM
Low EU	0.00
HIGH EU	40.00
LOW ALARM	5.00
HIGH ALARM	30.00
SET POINT	18.00
Process Variable	21.45

OK CANCEL

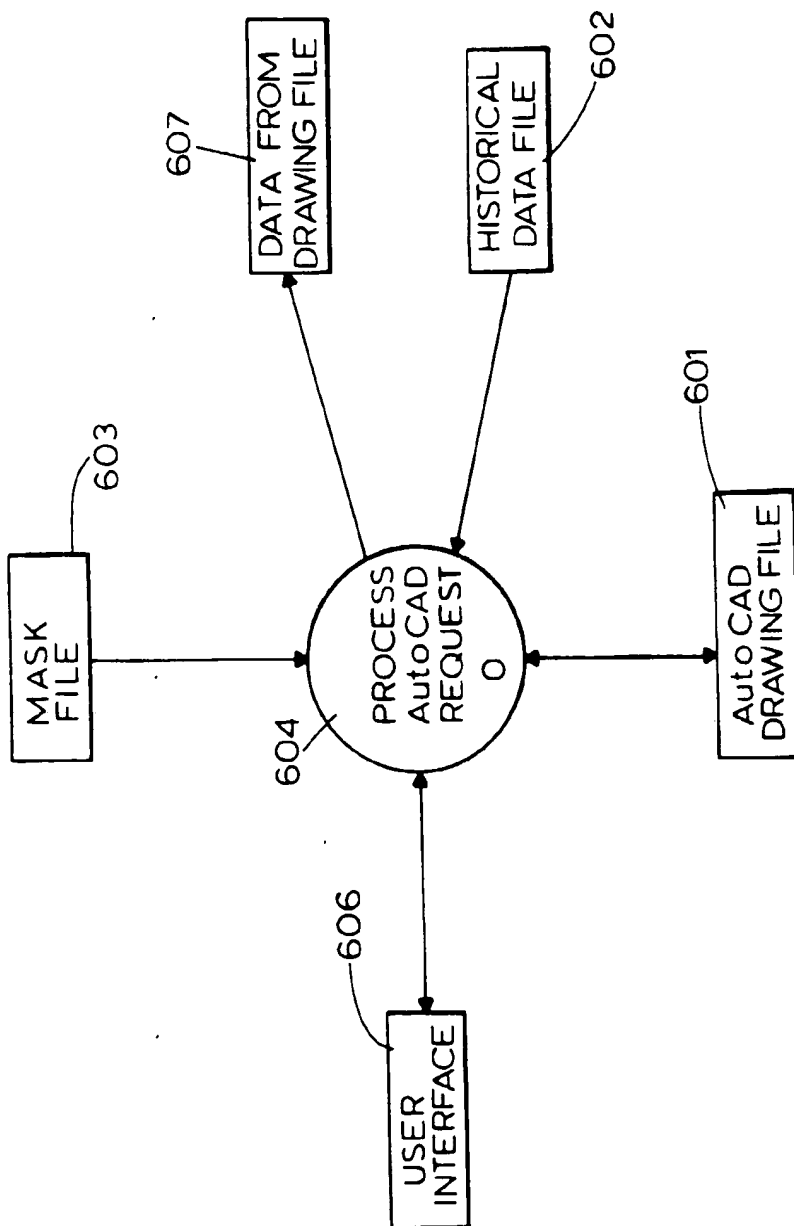
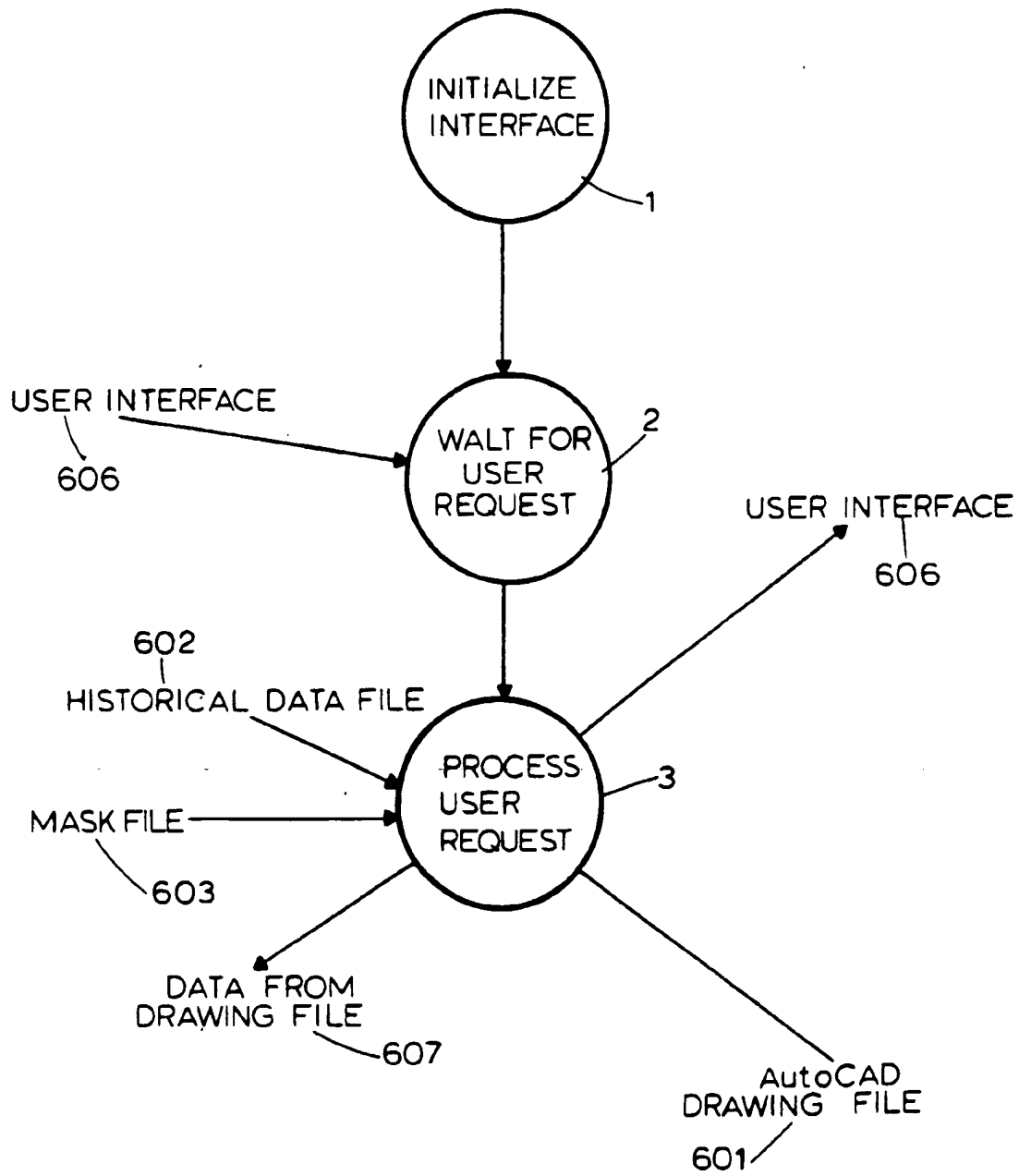


FIG. 6



**FIG. 7**

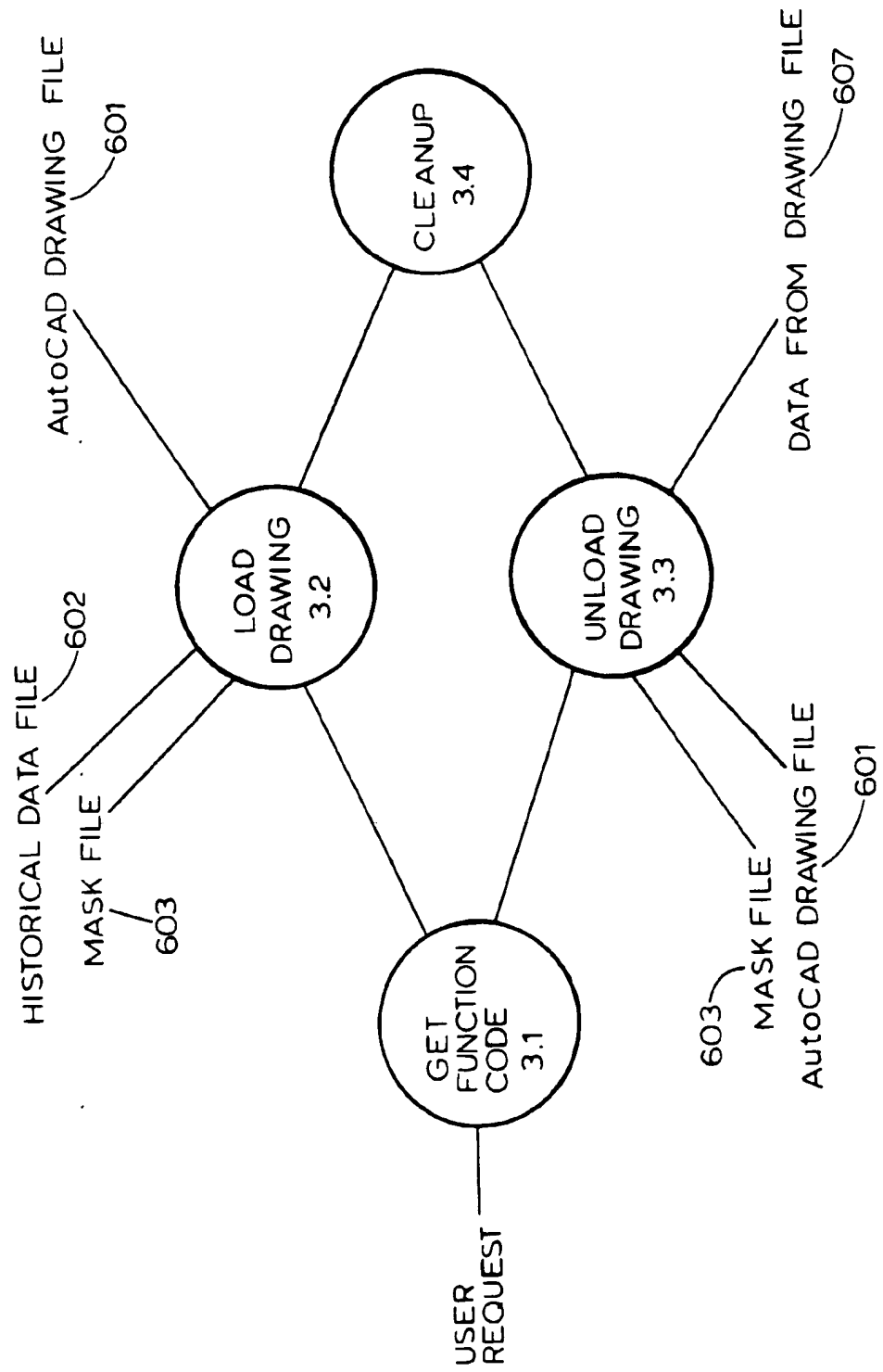
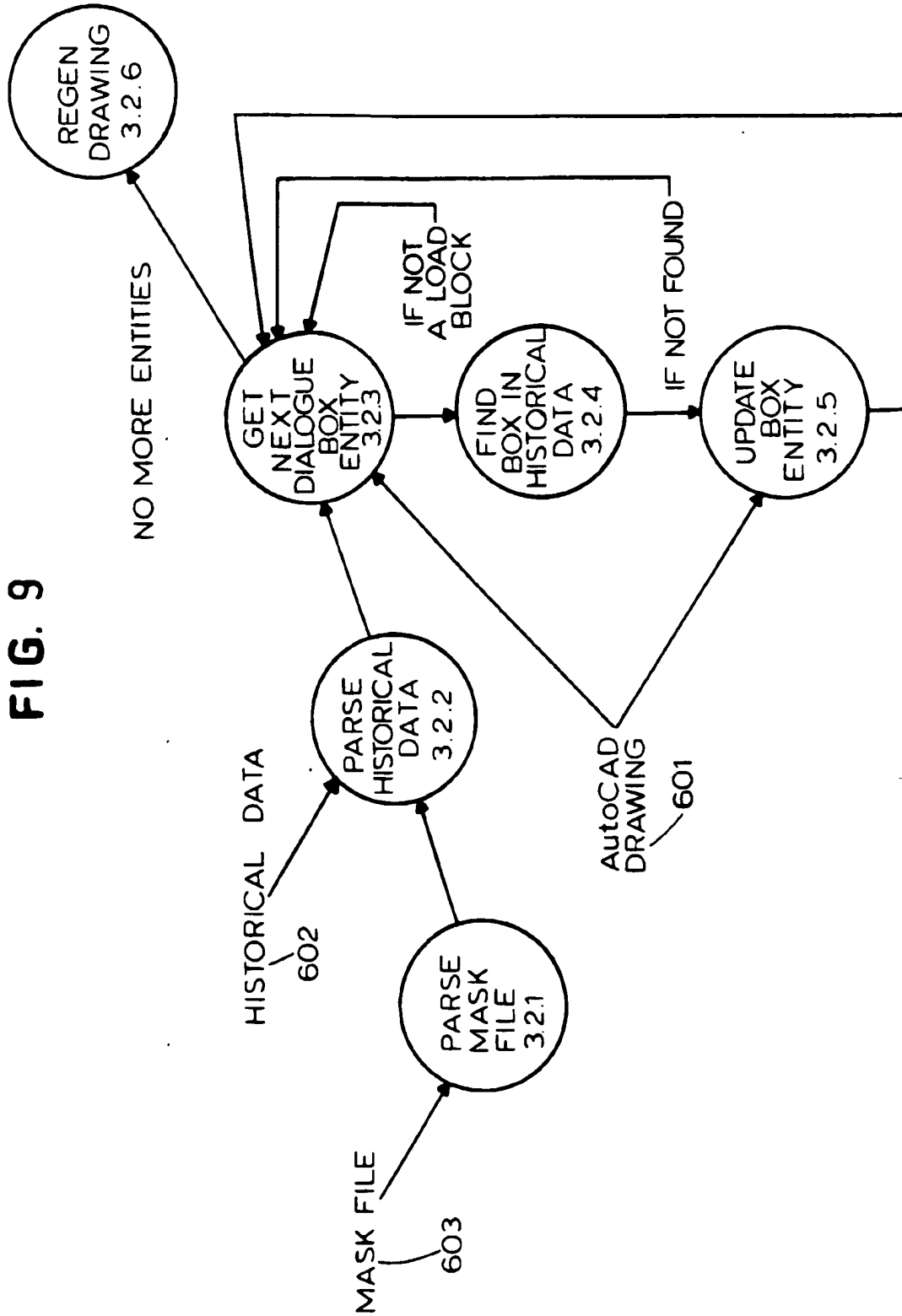
**FIG. 8**

FIG. 9



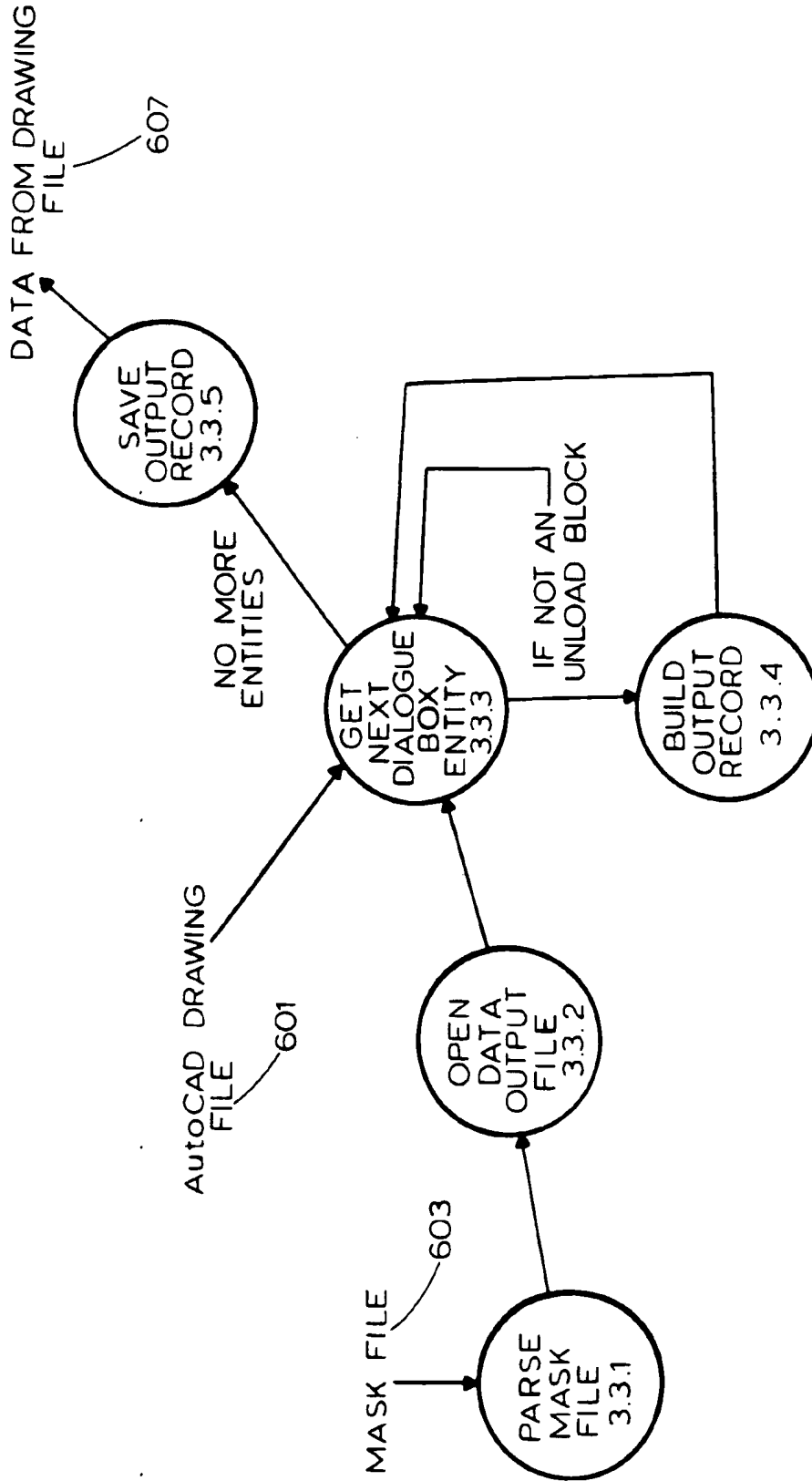


FIG. 10



**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**